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DEPARTMENT OF AGRICULTURE, BOMBAY.

BULLETIN No. 117 OF 1924.

~~Ag 577~~ Ag 537

~~AG 345~~

INVESTIGATIONS IN FIG CULTURE AND TREATMENT.

BY

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Printed at the Yeravda Prison Press.

1924.

[*Price Re.—0-5-6.*]

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INVESTIGATIONS IN FIG CULTURE AND TREATMENT.

I. Introduction.

The area in the Bombay Presidency now occupied by the fig crop is exceedingly small, and is almost restricted to one small sub-division (taluka) of the Poona District. In this taluka, Purandhar, it occupies 1,230 acres, and hence has considerable importance and is a source of substantial profit to the population. Elsewhere the area is negligible. Bijapur has 25 acres under the crop, and Hyderabad (Sind) has 20 acres. No other district has more than 6 acres, and so far, the area apart from the Poona District, has not shown any tendency to increase.

The crop is, however, one which might be extended far beyond its present boundaries, provided the exact climatic and soil conditions which are suitable for it were better known, provided the present low yield could be substantially increased, and provided a satisfactory and practical method of drying the figs, under the existing conditions, could be discovered and introduced.

The present paper gives an account of progress so far made in answering these demands. By a comparison of the successful and unsuccessful areas here, with those of the conditions in California where they are recognised as satisfactory, a judgment can be made as to the suitability of any place for fig culture. So far as yield is concerned, the very remarkable results which have been obtained by notching are described, the theory of this operation discussed, and the best method of carrying it out indicated. Thirdly, the results of a successful and feasible method of drying figs in the Poona District are described and the method employed given in detail.

II. Soil and Climate for Fig Cultivation.

The fig crop has in recent years extended the range of its cultivation very greatly and a study of the varying conditions under which it has been successful will enable us to judge what really are the conditions where it is likely to succeed.

So far as climate is concerned, the following conditions were laid down by Eisen* a number of years ago. There

* U. S. Dept. of Agric., Division of Pomology, Bull. No. 9 (Eisen).

must be, says this authority, two seasons, one rainy and one dry, the latter being in the warm season of the year. The more distinct the two seasons, the more likely is fig cultivation to be a success. Showers during the ripening season are very injurious. Further, warm dry winds during the ripening of the figs accompanied by sun-shine are an advantage. During the ripening there must also be an absence of clouds and fog but the temperature in the shade should not regularly exceed 100° F. Again the cold weather must not be intense, though a certain amount of frost may occur. The temperature must, however, never go down below 18° F. The whole rain of the year should be not less than twenty-five inches but this should be confined to the winter and spring months of the year. Finally, warm nights during the summer also favour the fig, its development and its quality.

In recent years perhaps the most successful acclimatisation of the fig crop has taken place in Lower California and many parts of this area have climatic conditions not widely different from those in the Deccan. The conditions and the type of fig cultivated may be described as follows:—

> The climate of this part of Lower California is dry. Rain, however, falls from June or July to November though the quantity is small and after a shower the ground dries quickly. Frost is rare and in summer the thermometer frequently reaches 115° F. The analogy of these conditions with those of the Deccan is very striking. Irrigation is required as the rains are seldom sufficient in quantity to sustain the trees and mature the fruits.
>
> In this part of California the type of fig grown is the "Black Mission". This belongs to the common class of edible figs which give fully ripened and mature figs without the process known as caprification. Its flowers are mainly mule flowers, though a few female flowers occur. No gall or male flowers are found.

The authority already quoted (Eisen) with regard to the climate has also specified the effect of varying conditions of soil in the success of fig cultivation and on the character of the figs produced. He states that heavy clay soils produced coarse figs, and this is especially the case when they are wet. Sandy soils on the other hand lead to the production of sweet figs which, when dried, are of a light colour. Figs to be eaten

fresh are less exacting as to soil than those intended for drying and more moisture can be tolerated than in the latter case. Figs for drying purposes require warm, moderately dry, fairly sandy soils containing a considerable amount of lime.

Thus we have conditions, at any rate in the Deccan, not only of climate but also of soil which would lead to the supposition that fig cultivation can be widely extended if only the other conditions limiting its extension can be met. The type of fig now cultivated here is also of a type not widely different from that already described as a great success in Lower California. The real natural barriers are the cloudy weather and untimely rains which may occur at ripening time. These do not often take place, however, and should not, we think, be serious obstacles in the way of an extension of fig cultivation if other difficulties can be met.

The actual conditions of rainfall which have prevailed at Saswad, which is the centre of fig cultivation in the Deccan at present, for each of the past ten years is given in the table attached to this chapter.

Rainfall recorded at Saswad (Purandhar), District Poona.

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Mean of 43 years.
January ...	...	0·08	...	...	0·05	...	0·54	0·05	...	...	0·04
February...	...	...	...	1·07	...	...	...	...	0·18	0 01	0·08
March ...	...	...	...	...	0·08	1·16	...	...	...	0·81	0·09
April ...	...	1·61	2·17	0·14	...	...	0·61	2·61	0·75	0·31	0·54
May ...	0·29	0·33	1·79	...	6·10	0·71	...	...	0·83	...	1·18
June ...	2 83	7 53	2·56	4·21	0·44	1·96	3 51	0·32	2·04	0·42	4·13
July ...	5·68	10·20	7·54	1·13	0·71	2·85	6·12	7·58	3 22	2·28	4·93
August ...	4·77	1 20	1·37	2·64	0·63	1·89	0·80	1·83	0·27	1·32	2·39
September.	4 41	9·22	6·46	6·20	1·91	7·88	4·16	0·63	0 22	3 26	4·28
October ...	0·42	1 18	3·73	5·5C	1·00	1·99	1·51	4·48	2·91	0·85	3 33
November.	0·70	0 69	1·99	2·33	0·68	0·71	...	...	10·16	...	0 97
December.	...	0 31	...	...	0·45	0·04	...	...	...	...	0·24
Total ...	19·10	32·35	27·61	23·28	12·05	19·19	17·25	17·50	20 58	9·26	22·20

III. The Increase of Yield of Fig Trees and the Effect of Notching.

One of the factors which limits the cultivation of the fig in the Bombay Presidency is the present low yield of the crop. This low yield is due almost certainly to the careless cultivation now adopted, for the plants are allowed to grow into bushes which are never pruned. Consequently new growth is scanty, and the yield proportionately low.

The influence of pruning on the rate of new growth is undoubtedly great, but the degree to which the trees can be forced by this means to bear a crop is unsatisfactory. It has been observed that when a branch of the fig tree is cut off squarely, a few buds, often one only, below the cut, develop into branches leaving the greater part of the stem naked. Such shoots during the growing period develop into long canes bearing fruit all along their length with very few side branches. As time advances, these canes assume the shape of long naked scraggy branches, the brush-like end portions of which would only bear fruits in season.

The inefficiency of pruning alone in commanding satisfactory fruit bud formation suggested notching trials to test the influence of this process on the growth of dormant buds. Before, however, describing the experiments in this direction and their results, we may describe generally some of the cardinal features of the growth of fig trees in the Deccan.

Method of growing Fig Trees in the Deccan.

All fig trees should be grown in such a manner that the foliage may be high enough above the ground freely to admit air and wind. If a single standard from the soil is desired, the trees may be allowed to grow for a year, and they will in this time attain a height of six feet. Then they should be headed back about four feet from the ground and as a result a number of side branches will arise immediately behind the cut. These should be encouraged at least nine inches apart from one another, in order that the crotches may not come close together. These side branches (or the second year's growth) bear a good crop in the second year of the plants and this is over by June, when the next pruning season draws near. From this time systematic annual pruning should begin and consists in the very light heading back of terminal

I.—Fig Trees at rest in the months of August and September.

portions of the growth which bore fruits in the previous season. The cardinal object in pruning fig trees is to encourage as great a growth of fruit bearing wood as is possible before November and December each season. Fruit set upon such wood has time to ripen before the rains set in. Pruning should, therefore, begin about the beginning of July and be completed by the tenth of that month.

In August and September the plants are resting, except in the case of one year old plants where little rest takes place. In other cases, however, the buds remain dormant, and no new growth takes place. The leaves turn yellow and fall. At the end of September the plants are bare canes but in October leaves again appear. The fruits develop in the axil of each leaf and as the branches grow, each new leaf means a new fruit in its axil.

At the end of October, the previous year's growth which was headed back now bears three or four new fruit bearing shoots which have developed from the buds near the cut end, and the branch looks like a brush. In fact the greater part of the stem remains naked, that is to say, the buds remain dormant. All these are capable of giving rise to fruit bearing shoots if they can be stimulated to do so. The purpose of notching now to be discussed, is to force these dormant buds to produce fruit bearing shoots.

Method of Notching.

Various methods have been used for this purpose, but before considering the theory of the subject at all, we may describe the method which has given extraordinary success in increasing the yielding capacity of fig trees. The method we have used is a very simple one. With a sharp knife two cuts are made in the bark as deep as the wood just a little above the dormant bud and the bark removed. Care must be taken to avoid the flow of the milky juice over the bud, as such juice may coagulate thickly over the bud and retard its growth. In practice to avoid this difficulty, the cuts should always be slanting, so that the milky juice may run away. The notch must be deep and wide in proportion to the size of the branch. The breadth of the notch may vary from one-sixteenth to a quarter of an inch. In about four days the bud below the notch swells and after eight days it sprouts. In two months time the shoots sometimes grow as

long as two feet. If the wound is shallow, it heals up quickly and the bud does not grow. If the notched-buds fail to grow it may be due to improper notching or to the unhealthy condition of the bud.

The bud selected for notching should be a large and plump one and be borne on perfectly mature wood which ought to be at least nine to twelve months old, or which has undergone a preliminary resting period. Almost every such bud can be made to start. If, however, all the mature buds on a branch are started by notching, only one or two survive in the long run, and perhaps these surviving shoots may not be in a very suitable position. (*See* Tables 4 and 5.)

The lowest three or four buds at the basal end of a branch are usually very difficult to start and do not respond well to notching. Those in the middle portion of the branch are the most suitable for the purpose as they are always plump and healthy, while those at the upper end are too young to be notched with the most successful results. The shoots so obtained in the middle portion of the branch are as good in vegetative growth and fruit bearing as those naturally borne on the terminal portions of the branch.

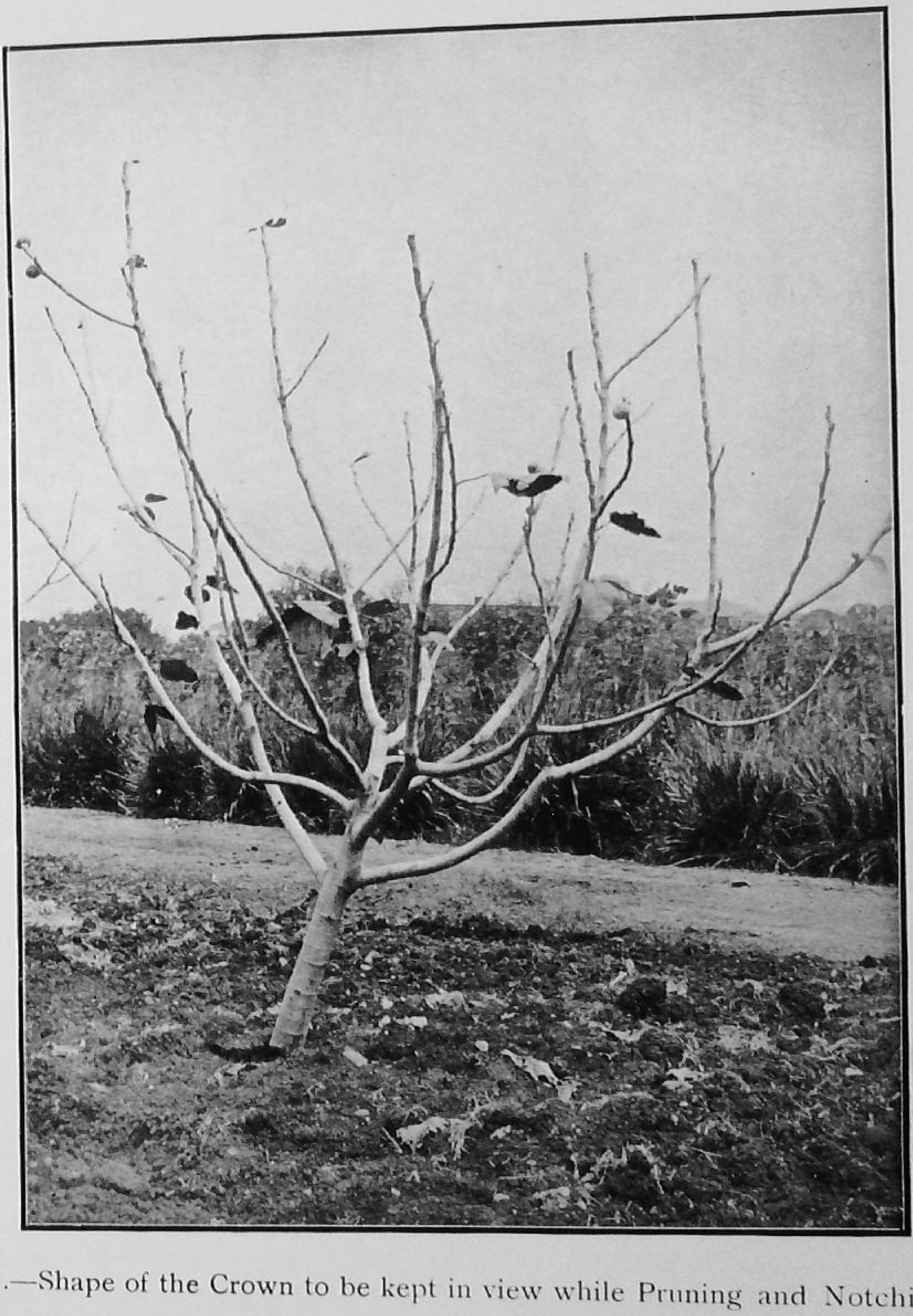
So far as the size of the notches is concerned, the following observations may be recorded: Notches one-twentieth inch in diameter on branches from 1 to $1\frac{1}{4}$ inch in diameter did not cause the buds to start while those double this width (one-tenth inch) were quite sufficient for the purpose.

It was also found that the notch should not be more than a quarter of an inch above the bud. It should be right across the branch and not merely up and down the branch. The latter type of notch does not influence the bud in any way.

In summary, therefore, we may indicate the methods of notching which have given us the best results. The data on which these conclusions are based are given in tables 4 to 5 at the end of the present bulletin—

(1) The bud selected for notching should be (*a*) healthy, plump, and of large size (*b*) borne on mature wood which has undergone a preliminary resting period (*c*) situated on the middle portion of a mature branch.

(2) Notching should be done with a clear idea of the form of tree which it is desired to produce. (*See* Plate II.)



II.—Shape of the Crown to be kept in view while Pruning and Notching.

(3) Not more than two buds must be notched on one branch.

(4) The notch must be sufficiently broad for it, not to heal before the bud starts. The slip of bark should be completely removed.

(5) The notch should be made just above a bud, and right across the branch.

Influence of Notching on the Two-Year old Fig Trees.

To make a definite statement as to what would be the increase per acre due to notching, is really difficult, as it much depends upon the conditions in which notching is done. The following points are worth noting :—

(1) Notching has a great influence on a young plantation as compared with an old one as the proportion of well developed big healthy buds is much greater on young plants than on old ones.

(2) The number of notched-bud shoots cannot be the same on every plant, as the number of notches decided to be performed on a particular tree depends upon the state of vegetative growth in which the tree is found. A tree which is a thickgrower by nature needs in fact a few buds to be notched; while a scraggy tree having branches in the shape of long naked canes with brush like leafy ends has to be operated at many places. Consequently in the former case we find little increase in yield by notching, while in the latter, a considerable number of fruit giving branches will be the direct result of notching operations.

However, to get an idea as to what extent notching can influence the yield per acre of fig trees, the figures have been obtained in 1923-24. (*See* Table 8.)

A count of eighty-two notched-bud shoots on eleven trees showed an increase of 588 fruits, *i.e.*, 53 fruits per tree.

Taking $1\frac{1}{2}$ ounces as average weight of a fig fruit (as worked out from the individual tree performance record for the year 1923) the weight of 53 fruits comes to 80 ounces or 5 lbs. So an increase of 5 lbs. per tree was effected as a result of notching treatment.

Taking it for granted an acre of land contains 193 trees planted fifteen feet apart, 965 lbs. of figs could, therefore, be

the possible increase in yield per acre in the third year of the plantation.

Other Observations on Notching.

Seasonal notching observations show that the buds which were notched in July develop sufficiently large shoots to bear fruits in the fruiting period. The shoots produced by notching later on, although vigorous and growing continuously, do not develop so rapidly as those from the July notching. Notching one year old plants in the manner described results in extraodinary vigorous shoots which bear fruit mostly at the middle and the apical portion of the branches and not at the base. The fruits in such notched-bud shoots in one year old plants, however, give fruit very late in the season and in fact, the crop may not be finished before July. Shoots obtained by notching in two year old plants stop their growth and become leafless in August and September. They start growing again very vigorously together with the other new growth on that tree in October and begin to bear as early as the rest of the new growth. They begin bearing from the very basal portion. Further, a notch on the trunk of the tree tends to heal more quickly than one on a main limb or a subsidiary branch.

We may here note the fact that apparently dormant fruit buds borne on the naked portion of the mature wood of the previous season often develop into fruits before or after the new growths in October have started. Most of these fruits turn yellow and drop in November before they are ripe. However, a few ripen, but they are much less sweet than the fruits borne in the normal manner. The stalk of such fruits is generally very short.

The new fruiting branches for the normal crop of the year cease growing at the end of December and then the fruits begin to increase in size.

At this stage it is worthwhile mentioning that the operation of notching gives much less irritation to the plant than other methods adopted to accelerate its productiveness, and it takes one or more months according to the season to fill up the notch. After four months the new branches which were obtained as a result of notching become so thick that the scars of notches above them can hardly be traced. We

III.—Comparison of Growth of Notched-bud Shoot, and of Terminal Branches.
A B is the Notched-bud shoot.

have never found any parasitic fungi or insect pest developing as a result of the notching.

The evidence for the statements made above with regard to notching will be found in tables 1 to 3 and 6 to 9 at the end of the present bulletin.

Theory of Notching.

We have now described the method of notching which we have adopted and the results obtained. But the theory of the operation is by no means clear and various authorities have differed very much as to what is its real effect botanically upon the plant.

Sorauer* has observed that a notch made above a dormant bud diminishes the upward current of water in the plant and consequently the bud gets more water and grows rapidly, while a notch below the bud helps in the accumulation of the plastic material, normally passing downward in the parenchymatous cells, in the neighbourhood of the bud which thus supplied remains bunchy and is very prone to change into a fruit bud. Passy † has described how a notch below a branch may weaken growth, while one above strengthens it. Vercier† has supported this statement, but both authors have brought forward no evidence for their conclusions.

Bailey § gives the following as his conclusions with regard to notching:—

(*a*) Notching *into the wood above* a bud, tends to produce strong growth from that bud.

(*b*) Notching *just through the bark above* a bud tends to weaken the bud, because the root sap is not stopped and the elaborated sap *is* stopped.

(*c*) Notching *into the wood below* a bud tends to pile up reserve materials at the bud, and thereby to induce fruit bearing.

(*d*) Notching just through the bark below a bud tends to pile up tissue at the bud, but since the root-sap is not cut off, the bud may use this tissue in rapid growth and fruit bearing, therefore, may not be induced.

* Sorauer a Popular Treatise on the Physiology of Plants, 1895, p. 158.

† Passy and Vercier—Ann. Rept., Agri. and Hort. Stn., Long Ashton, Bristol 1919, page 93.

§ Bailey—Pruning Book, p. 169.

In support of these statements, Bailey quotes the work of Koopmann, * the conclusions from which are as follows :—

(*a*) Notches *into the bark below* a bud are equivalent to one-third or one-fourth girdle.

(*b*) Notches *into the sap-carrying wood above* a bud have a contrary effect, as of a one-third or one-fourth cutting back. The deeper into the sap-carrying tissues the knife advances, the more pronounced must be the result. The crude sap taken up by the root and not directly of use in building tissue can only do the work of fitting for use the stored reserve of materials. For these reserve materials thus set into solution there is no other outlet than to be worked up and used in a dormant leaf bud or in a newly forming adventitious bud below the notch.

(*c*) Notches *into the bark above* a bud, and notches *into the wood below* a bud, cannot attain any practical importance.

(*d*) Notches *removing only bark and bast layer above* a bud must tend to enfeeble the bud and prevent sprouting. Koopmann did get some sprouts by notching the bark above the bud but he states that by close examination of the notch he found he had injured the younger layers of the wood also.

(*e*) Notches *into the sap-carrying wood below* a bud. The bud is cut off from the roots, and the cambium fluids are piled up at the bud, which is therefore, too abundantly supplied with reserve materials without itself being caused to grow. The deeper the sap-carrying wood layers are cut the less is the tendency of the bud to develop a shoot and it usually remains as a well-developed fruit bud without any clearly observable lengthening of the axis, as though sleeping, or it develops a leaf rosette, in order to bear fruit in the following year.

Barker and Lees †, however, express the latest view of the subject. They believe that food substances are not altogether responsible for the dormant condition of the buds,

*Koopmann—Landwirtschaftliche Jahrbucher, XXV (1896).

†Barker and Lees—Factors governing fruit bud formation : Ann. Report, Agricultural and Hort. Res. Stn., Long Ashton, Bristol, 1919.

IV.—Effect of notching above and below a bud. Notching below the bud has prevented growth and kept the bud dormant. The bud with a notch above has grown into a vigorous shoot.
(Date of notching, 10th November 1922.)

but that an inhibitory substance flowing downward through the stem brings most of the lateral buds on the basal part of a branch to a standstill, only allowing a few of the apical buds to continue growth. This assumption, therefore, suggests that notching above the bud may lead to increased shoot production.

There is thus a distinct cleavage of opinion on the subject between the older views represented by Sorauer, Bailey and Koopmann quoted above and the later ones represented by Barker and Lees. Let us see how in the four typical cases our results justify either of these positions.

1. Notches above the Bud through the Bark only.

Bailey and Koopmann consider that such a notch would enfeeble the bud and prevent sprouting.

Barker and Lees state that the notched bud made more growth than similar buds on untreated twigs.

Our experience in notching fig branches gives results agreeing with those obtained by Barker and Lees.

2. Notches above the Bud into the Wood.

Bailey and Koopmann consider that such a notch would produce strong growth from the bud and this view is supported by Sorauer.

Barker and Lees give no opinion on this particular case.

Our experience has been that in notching fig branches, it matters little whether the woody tissue is cut into a little or not. The result when such cutting takes place is not different from that obtained when the bark is merely cut through. The cutting of the young wood does not seem to be essential in making the bud grow; the cutting of the cortex and bast is only necessary.

3. Notches below the Bud through the Bark only.

Bailey considers that this operation will tend to pile up tissue at the bud which may be used in inducing rapid growth.

Barker and Lees did not succeed in inducing the growth of a shoot by notching through the bark below a bud.

Our experiments gave negative results like these of Barker and Lees. We were not able to induce growth by this method. (*See* Plate IV.)

4. Notches below the Bud into the Wood.

Bailey considers that reserve materials will be piled up at the bud, and fruit bearing, therefore, caused.

Koopmann thinks that the bud will simply remain as a well developed fruit bud or develop a leaf resette in order to bear fruit in the following year.

Sorauer considers that the conditions will be favourable to the formation of flowering buds.

Barker and Lees have conducted no experiments on this point.

Our results have hitherto been entirely negative and we were not able to induce growth by this method.

The results obtained in our experiments tend, therefore, in every case where they can be compared, to agree with those which would be obtained on the hypothesis of Barker and Lees. This does not necessarily justify their theory of an inhibitory substance in the descending sap and seems capable of a more simple explanation. The points which seem clear are (1) that the ascending sap in the branch is indispensable for the growth of the bud, (2) that the elaborated descending sap is *not* necessary for starting growth. The dormant bud has its own stored food material to make use of in its growth, (3) that what the bud requires to induce it to grow is the usual water supply from below and a reduced pressure of elaborated sap immediately above it.

When a slip of bark just above the normal bud is removed, the elaborated descending sap which runs to the bud is cut off from the bud and so reduces the pressure on that side. It, therefore, begins to grow. The effect is, therefore, not different whether the wood is cut into or not.

IV. The Sun-drying of Poona Figs.

The growing of figs in Western India is almost a speciality of the Poona District. But, inasmuch as they will not carry far in good condition, cultivation, for which the tract is very suitable, cannot expand beyond a very small area. At the same time, the Bombay Presidency alone imports nearly five lakhs of pounds of dried figs from abroad each year, chiefly from Persian Gulf, Afghanistan and Greece and to a slight extent from California. The best among

these foreign dried figs (*viz.* "Bottled Evaporated Calimyrna") are sold at Rs. 1-8-0 per pound in the months of August and September in the Bombay market, but if the Poona figs can be dried satisfactorily and put on the market, they can be sold at ten annas a pound and still yield a handsome profit, and will be in great demand especially from June to September when there is a scarcity of foreign figs.

In any case dried figs have a world market. The principal exporting centres before the war were Turkey, (by far the largest), Italy, Greece and Algeria, while the large consuming centres were the United Kingdom, the United States of America, Austria-Hungary, France and Russia. To capture the foreign market is perhaps a far distant goal but it is certainly well worthwhile to see whether good dried figs can be economically produced suitable for the Indian market. If this were found possible the present area of figs in the Poona District (1,230 acres) would soon rapidly increase.

The Poona fig is a medium sized bell-shaped, light purple coloured fig and is, in good samples, nearly six inches in circumference at the broadest end. The stalk is long and the apex flat The skin is thin, ridged, slightly downy and is easily removable. The pulp is rosy red. The seeds are soft and without a kernel. The average weight of the fresh fruit is 1½ ounces. On analysis in the Chemical laboratories of the Bombay Agricultural Department, the fresh fruit gave the following figures :—

Moisture	...	75·0	per cent.
Reducing sugars	...	15·2	,,
Non-reducing sugars	...	2·1	,,
Total sugars	...	17·2	,,

The completely dried fig gave the following additional data on analysis:—

Ash	...	3·2	per cent.
Ether extract	...	0·7	,,
Proteids	...	4·7	,,
Digestible Carbohydrates	...	89·3	,,
Woody fibre	...	2·1	,,

The dried figs which we have been able to prepare from these fruits are not so sweet and aromatic as the first grade Smyrna fig, but their size, colour and softness of the meat

very attractive. Their market quality is at least as good as that of any dried fig available in the local market, and is probably superior to all. On analysis they gave the following figures, compared with those of foreign figs available :—

	Moisture per cent.	Reducing sugars per cent.
Sun-dried Poona fig ...	19·25	45·95
Persian fig, Sample I ...	19·45	46·30
Persian, Sample II ...	19·90	45·70
Afghanistan fig ...	19·04	46·64
Grecian fig ...	19·14	46·50
Smyrna fig ...	18·25	57·31

The process of drying and curing figs differs somewhat in different countries, largely on account of the differences in the cultivated figs themselves. They are extensively dried in Turkey in Asia, Greece, Italy, France, Spain, Portugal and Egypt and more recently in California. In Asia Minor and Greece, figs are only sun-dried on drying floors. In Italy figs are split lengthwise, dried in the sun and dipped for a moment in boiling water which is then drained off. In France they are exposed to the sun as in Turkey, and then after two or three days' exposure, they are sweated for forty eight hours in boxes and again finally dried in the sun. In California fresh figs are treated with burning sulphur fumes for about twelve minutes and then dried in the sun. Salting of fresh figs or half dried figs is also regarded as an important operation in many countries but its use with the Poona figs has not, in our experience, increased the market value.

A series of experiments (details of which are given in table 10) with the drying of Poona fig has led to the following process as suitable to them.

Well ripened figs are carefully picked. Careful picking is essential. The contents of figs subject to careless picking always ooze out while drying, and attract ants and flies during the drying process. Fresh fruits are then spread in single layers in suitable trays and exposed to moist sulphur fumes in a closed wooden box. The exposure to moist sulphur fumes bleaches the fruits and makes them semi-transparent. The fumigation, too, checks the growth of micro-organisms, which would otherwise spoil the fruits dur ing the curing period. The simplest method of fumigating with

V.—Sulphuring and Drying figs.

sulphur fumes is to ignite flowers of sulphur below the perforated trays which are made to slide one above the other on cleats nailed to the sides of an ordinary closed wooden box. The lowest tray, which is at least eighteen inches above the bottom of the box is moistened with water and does not contain any figs.

A rectangular deal wood box, about 12 cubic feet in capacity (as illustrated in plate V), can very easily fumigate 50 lbs. of fresh figs at a time. The sliding trays are made of wooden strips and wire netting and are 18 inches by 21 inches in size. The wire netting should be the best grade of galvanised screening obtainable with meshes one-fourth inch square.

Numerous experiments with various modifications of the treatment lead to the conclusion that twenty to thirty minutes' exposure to sulphur fumes is essential to get tasteful produce. Longer exposure, however, encourages acidity which is undesirable. Regarding the time required for bleaching and the quantity of sulphur necessary to accomplish the desired end, one must bear in mind that no definite rules can be put down. The aim is to treat until enough of the fumes have acted upon the figs to bleach them. If it is found that the colour of the figs is not properly bleached, the length of time that the fruit is kept in the box must be increased or more sulphur should be burnt in a certain period. The fumes may be started by putting a few live coals into the receptacle used for the purpose and then adding flowers of sulphur. In a box of the size above described four ounces of flowers of sulphur are enough to fill it up with dense fumes.

If the figs are not sulphured the final colour is dark and unattractive, and a preliminary dipping in boiling water containing salt gave no advantage, for though the taste was good yet the final colour was not very attractive and the figs took a little longer to dry.

Immediately after sulphuring in the manner described, the figs are transferred very carefully to wooden racks and exposed to the sun. The size and dimensions of the racks should be such as one can easily reach across from either side. Bamboo matting, three feet wide supported four feet above ground on bamboo posts, has been found to serve the purpose well. Then the figs are turned over daily in order

to get the fruit evenly dried and semi-transparent appear- ance. If this operation is neglected, the bright pearance of the dried fruit is lost.

The months of April and May seem to be the best for drying figs in the sun as there is then no fear of rain. Five to seven days are needed for complete drying. Provision against untimely rains may be made by keeping a roll of water-proof canvas ready at hand which can be run over the drying racks whenever required.

Figs thus treated, when fully dried, are pliable and semi-transparent and are reduced to a little less than one-third of the original weight. A well dried fig when pressed should not resume its former position but remain as pressed. An over-dried fig is leathery and tough. As all the figs do not dry at one time, daily removal of perfectly dry figs is necessary. The moisture contents of the dried figs range between 17 and 22 per cent.

Before drying is completed, figs are pulled flat as evenly and neatly as possible to economise packing space and to improve the market appearance. Neatly pulled figs take a circular shape with their eyes in the centre on one side and the stalk on the other.

Now the figs may be graded according to their size and colour. Our sun-dried figs can be separated into at least two grades. The first grade figs present a semi-transparent rosy skin beautifully streaked at the stalk end. The second grade are darker and less attractive in appearance.

The practice of dipping the dried figs in salt boiling water before packing for market has been regarded as an important operation in fig growing countries and our figs also have responded well to this treatment. Dipping makes them soft and improves the taste. Especially the second grade figs are much benefited by this treatment. The process consists in dipping the dried figs in boiling salt water (proportion :—5 ounces of salt in 1 gallon of water) for a few seconds. After dipping, the figs must be emptied on a wire screen frame in a shady place to drain off the water. Dried figs thus treated are ready for packing for market.

If these instructions are carefully observed a product much superior to the commonly obtainable foreign figs can be put in the market. There is, in fact, a great scope for developing a fig-drying industry in the Bombay Presidency.

As this industry does not require any capital outlay at any rate, when conducted by the small cultivators who now grow figs, it can be easily taken up by the villagers as a cottage industry, particularly when the rate of fresh figs is very low as is usually the case in the month of May and the first half of June in each year.

My thanks are due to Mr. G. S. Cheema, Horticulturist to the Government of Bombay, for the suggestion of the work and experiments recorded in the present bulletin, and for continued inspiration during its progress.

TABLE 1.

Preliminary observations on the influence of July notching on trunks of one year old plants.

Date of notching, 19th July 1922.

Tree.	Number of buds notched.	Observations on the sprouting of buds, 1st August 1922.	Length measurements of the notched-bud shoots, 4th November 1922.	Length measurements of the notched-bud shoots, 5th July 1923.	Remarks.
1	1	Sprouted ...	2′—4″ ...	7′—6″	Fruits were borne at the middle and the apical portions only. The crop from these notched-bud shoots did not finish before July 1923.
2	2	One swelled .. One sprouted ...	Failed to develop ... 5½″.	3	
3	3	Two swelled .. One sprouted ..	6″; 2′; 1′—11″. ...	4′: 6′—3″; 5′- 5″	
4	3	One swelled ... Two sprouted ...	Two buds failed to develop. The surviving one is 2′—6″.	6′—10″	
5	1	Sprouted ...	1′—1″ ...	6′—3″	
6	2	One swelled ... One sprouted	One failed. ... 2′—6″	6′—3″	
7	1	Sprouted ...	1′—3″ ...	6′	
8	3	Three sprouted ...	One failed; 1′—11″; 10″ ...	6′; 6′	
9	2	Two sprouted ...	7″; 1′	2′—9″; 6′—4″	
10	2	Two sprouted ...	3″; 8″ ...	3′—6″; 4′—9″	
11	1	Sprouted ...	2′—2″ ...	5′—2″	

TABLE 2.

The influence of October notching on the growth of dormant buds on trunks of one year old plants.

Date of notching, 26th October 1922.

Trees.	Number of buds notched	Observations. 1st November 1922.	4th November 1922.	10th November 1922.	4th December 1922.	10th January 1923. Number of leaves.	Length of the notched-bud shoot.	Remarks
1	1	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.	Healing of the notch started from the corners.	9	$8\frac{1}{2}$"	After January there was very little progress in the length of the notched-bud shoots. None of these notched-bud shoots bore fruits in the fruiting season. Wounds had nearly healed at the end of January.
2	2	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.	Healing not yet started.	7 1	5 " $\frac{3}{4}$"	
3	2	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.	Slight healing in one of the corners.	6 7	$3\frac{1}{2}$" 4 "	
4	1	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.		8	5 "	
5	1	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.		7	6 "	
6	1	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.		10	10 "	
7	1	All buds have swelled and thrown out the brown covering.	All buds opening.	Leaves expanding.		8	$4\frac{1}{5}$"	

TABLE 3.

The influence of December notching on main limbs of fig trees.

Tree.	Date of notching.	Number of buds notched.	Observations on 3rd January 1923.	Observations on 20th January 1923	Observations on 7th February 1923.	Remarks.
1	20-12-1922.	3	Buds swelling.	One failed to grow and two started.	Length of the shoot, 2·5″.	
2	22-12-1922.	7	Buds swelling.	All buds sprouting nicely.	Length of the shoot, 2·5″.	Growth of the new shoots is slow.
3	22-12-1922.	7	No marked change in the development of buds.	Only one bud has opened and put forth three leaves.	Other buds have remained dormant.	Fruits were not borne on the notched-bud shoots in the fruiting season

TABLE 4.

Influence of notching on successive buds.

Date of notching, 9th April 1923. Diameter of the branch operated—1¼".

Bud No.	Dimensions of the bud in mm.	Width of the notch.	Position of the bud on the branch.	Preliminary remarks on every individual bud.	Observations on 16th April 1923.	Observations on the 21st April 1923.	Observations on the 26th April 1923.	Remarks.
1	3 × 3	1/10"	Basal ...	Flat, very dormant ...	Dormant ...	Dormant ...	Dormant.	All basal buds have remained dormant excepting Nos. 4 and 9.
2	4 × 4	„ ...	„ ...	Slightly plump, greenish...	Do. ...	Do. ...	Do.	
3	3½ × 2½	„ ...	„ ...	Slightly plump, brown ...	Slightly developing	Do. ...	Do.	
4	3½ × 4	„ ...	„ ...	Plump, greenish brown ...	Do. ...	One leaf sprouted ...	Progressing.	
5	(a) 4 × 2½	„ ...	„ ...	Very plump, brown ...	Do. ...	Dormant ...	Dormant.	
	(b) very small.	„ ...	„ ...	Very dormant (fruit bud).	Do. ...	Do. ...	Do.	
6	(a) 3½ × 3½	„ ...	„ ...	Very plump, roundish (fruit bud).	Do. ...	Do. ...	Do.	
	(b) 3 × 4	„ ...	„ ...	Flat and triangular ...	Dormant ...	Do. ...	Do.	
7	6½ × 4½	„ ...	„ ...	Very plump, triangular, greenish.	Slightly developing.	Do. ...	Do.	
8	(a) 5½ × 4½	„ ...	„ ...	Plump, triangular, greenish.	Dormant ...	Do. ...	Do.	
	(b) 1 × 4	„ ...	„ ...	Plump, roundish, brown (fruit bud).	Do. ...	Do. ...	Do.	
* 9	7 × 5	„ ...	„ ...	Very plump, triangular, brown.	Brown covering thrown out.	1 leaf opened ...	2 leaves opened.	
10	9 × 5½	„ ...	„ ...	Extra plump, triangular, brown.	Dormant ...	Dormant ...	Dormant.	
*11	5½ × 5	„ ...	Middle ...	Plump, brown ...	Do. ...	Throwing out brown covering.	About to open.	All buds in the middle portion of the branch have started.
*12	6 × 4½	„ ...	„ ...	Plump, triangular, greenish.	1 leaf opening ...	4 leaves ...	Progressing.	
*13	(a) 6 × 5	„ ...	„ ...	Plump, triangular, brown.	Dormant ...	About to open ...	Progressing.	
	(b) 5½ × 3½	„ ...	„ ...	Plump, cylindrical (fruit bud).	Do. ...	Dormant ...	Dormant.	
14	6½ × 5	„ ...	„ ...	Plump, triangular, greenish.	Brown covering thrown out.	About to open ...	Progressing.	
*15	6 × 5	„ ...	„ ...	Do. ...	About to open ...	2 leaves ...	Do.	
16	7 × 5	„ ...	„ ...	Do. ...	Dormant ...	Dormant ...	About to open.	

*Survived but all have remained very short branches. Nos. 9 and 11 are very weak branches bearing little or no fruit. Besides they are not in a very suitable position.

TABLE 5.

Influence of notching on successive buds.

Date of notching, 9th April 1923. Diameter of the branch operated—1″.

Bud No.	Dimensions of the bud in mms.	Width of the notch.	Position of the bud on the branch.	Preliminary remarks on every individual bud.	Observations on the 16th April 1923.	Observations on the 21st April 1923.	Observations on the 26th April 1923.	Remarks.
1	4 × 4	1/20″	Basal ...	Weak, brown ...	Dormant ...	Dormant ...	There is no marked change in the condition of dormant buds.	All these buds remained dormant hereafter.
2	(a) 4 × 4	,,	,, ...	Flat, brown ...	Do. ...	Turning green ...		
	(b) 3 × 3	,,	,, ...	Do. ...	Do. ...	Do. ...		
3	(a) 4 × 3	,,	,, ...	Plump ...	Do. ...	Dormant ...		
	(b) Very small.	,,	,, ...	Very dormant (fruit bud).	Do. ...	Do. ...		
4	5 × 5	,,	,, ...	Plump, brown, triangular.	Swelling ...	Turning green ...		
5	$4\frac{1}{2} \times 4\frac{1}{2}$	,,	,, ...	Do.	Do. ...	Do. ...		
6	$5\frac{1}{2} \times 5$	,,	,, ...	Plump, greenish, triangular.	Do. ...	Do. ...		
7	$4\frac{1}{2} \times 4\frac{1}{2}$	,,	,, ...	Slightly plump, greenish, triangular.	Do. ...	Do. ...		
8	(a) $3\frac{1}{2} \times 3\frac{1}{2}$	,,	,, ...	Plump, brown, (fruit bud).	Dormant ...	Dormant ...		
	(b) Very small.	,,	,, ...	Triangular, very dormant.	Do. ...	Do. ...		
9	$5 \times 4\frac{1}{2}$	,,	Middle ...	Plump, greenish, triangular.	Swelling ...	Turning green ...		
10	(a) $5\frac{1}{2} \times 3\frac{1}{2}$	,,	,, ...	Plump, round, brown (fruit bud).	Dormant ...	Dormant ...		
	(b) $3\frac{1}{2} \times 3\frac{1}{2}$	,,	,, ...	Greenish, triangular, flat.	Do. ...	Do. ...		
11	4 × 4	,,	,, ...	Greenish, triangular, plump.	Swelling ...	Green ...		
12	$3\frac{1}{2} \times 3\frac{1}{2}$	,,	,, ...	Triangular and flat ...	Do. ...	Do. ...		
13	$4\frac{1}{2} \times 4$	,,	,, ...	Greenish, triangular, plump.	Do. ...	Dormant ...		

TABLE 6.

Notched-bud shoots vs. *terminal shoots.*

Growth ratings compared, 22nd January 1924.

Tree No.	Branch.	Measurement of the *notched-bud shoot* in the middle of the branch in inches.	Measurements of the *terminal shoot* at the end of the branch in inches.	No. of fruits borne by the *notched-bud shoot.*	No. of fruits borne by the *terminal shoot.*
1	1	20½	16	9	8
	2	24	30½	5	9
	3	40	34½	13	10
2	4	26½	20	9	10
	5	28	26½	13	13
3	6	13	13½	4	3
4	7	14	16½	6	7
	8	27½	22	11	13
	9	16	21	9	15
	10	10½	20	4	10
	11	13	19	5	12
5	12	32	28½	9	9
	13	32½	25	11	11
	14	17	31½	4	9

TABLE 7.

Notching buds on trunk, main limb, and subsidiary branch.

Date of notching, 11th April 1923.

Position of the notch on the tree.	Observations on the 16th April 1923.	Observations on the 21st April 1923.	Observations on the 24th April 1923.	Remarks.
On trunk ...	Bud swelling.	Bud opening.	Notched-bud shoot making progress.	The sprouting of the bud on the trunk shows how the position of the notch in the body of the plant influences the result. The wood of the main trunk is older than that of the main limb or the subsidiary branch. It is to be noted that the bud on the trunk has undergone a longer resting period than the buds on the main limb or subsidiary branch.
On main limb.	Dormant ...	Dormant ...	Bud swelling.	
On subsidiary branch.	Do. ...	Do. ...	Dormant ...	

TABLE 8.

Influence of notching on yield of fig trees.

Tree.	Number of notched-bud shoots.	Number of fruits borne by the notched-bud shoots.	Remarks.
1	10	146	53 fruits per tree is the average increase.
2	8	81	
3	6	32	
4	16	74	
5	3	29	
6	7	49	
7	6	39	
8	9	47	
9	6	40	
10	4	16	
11	7	35	
Total ...	82	588	

TABLE 9.

Influence of notching below *the buds.*

Tree No.	Date of notching.	No. of buds notched.	Observations on 1st November 1922.	Observations on 4th November 1922.	Observations on 20th November 1922.	Remarks.
1	26th October 1922 ...	1	Failed to grow ...	Failed ...	Failed.	Growth of these dormant buds could not be induced by notching *below*.
2	Do. ...	1	Do. ...	Do. ...	Do.	
3	Do. ...	1	Do. ...	Do. ...	Do.	
4	Do. ...	1	Do. ...	Do. ...	Do.	
5	10th November 1922 ...	1	...	...	Do.	
6	Do. ...	1	...	...	Do.	
7	Do. ...	1	...	...	Do.	
8	Do. ...	2	...	...	Do.	
9	Do. ...	1	...	...	Do.	
10	Do. ...	1	...	...	Do.	
11	Do. ...	1	...	...	Do.	

TABLE 10.

Details of Experiments on the Sun-drying of Poona Figs.

Sample No.	Quantity of fresh figs in ounces.	Dry product obtained, in ounces.	Per cent. of drying.	Treatment before drying.	Remarks.
1	64	1	32·7	Exposed to fumes of burning sulphur for 30 minutes.	Colour pink rosy and very attractive; taste very slightly acid; acidity 1·43 per cent.
2	40	13	32·2	Exposed to fumes of burning sulphur for 25 minutes.	Do.
3	71	17¾	25	Do. ...	Do.
4	96	28	29·1	Do. ...	Colour dark pink due to cloudy weather for sometime; taste slightly acid.
5	48	12	25	Exposed to fumes of burning sulphur for 15 minutes.	Colour darker than the samples 1, 2, 3 & 4; taste sweeter than the samples 1, 2, 3 & 4; acidity 1·07 per cent.
6	32	9½	29·8	Exposed to fumes of burning sulphur for 10 minutes.	Colour darker than No. 5; taste as sweet as No. 5.
7	32	10	31·2	Exposed to fumes of burning sulphur for 15 minutes.	This sample was dipped in salt boiling water (1½ lbs. in 100 gallons of water) for 2 minutes when half dried. Colour not attractive.
8	32	10	31·2	Do. ...	Exposed at night time to cool weather; colour not attractive.
9	43	12½	29	No treatment was given ...	Colour dark and unattractive; taste sweet; over dried.
10	......	......	......	Dipped in salt boiling water (1½ lbs. salt and 100 gallons of water) for 2 minutes.	Colour unattractive; takes a little longer time to dry, and the drying is not satisfactory. However, the taste of the dry product is in no way inferior to the sulphured figs.
11	......	......	......	Exposed to fumes of burning sulphur for 30 minutes.	The figs in this lot were injured in the store. While drying, considerable sugary substance oozed out from the split skin.

TABLE 11.

The branching habit of the fig tree.

No. of trees recorded.	No. of branches given out as a result of heading back on the 25th May 1922.	Number of branches which bore laterals.	Total number of laterals.	Remarks.
28	265	137	314	(1) The percentage of branches which bear laterals after pruning is 51·6. (2) Ratio of laterals to the main branches is 1·18 : 1.

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